

Primate locomotion and vestibular morphology, with special reference to *Adapis*, *Necrolemur* and *Megaladapis*. F. SPOOR, University College London, WC1E 6JJ, U.K. A. WALKER, Pennsylvania State University, University Park, PA 16802, J. LYNCH, P. LIEPINS, UMDS Guy's Hospital, London, U.K. and F. ZONNEVELD, Utrecht University Hospital, The Netherlands.

The diversity of locomotor behaviors found in primates makes them an ideal group in which to study the relationship between locomotion and the semicircular canal system. This system records angular head movements and, through the vestibular reflexes, plays an important role in the coordination of eye, head and body movements. This coordination is vital for navigating the environment. Evidence from many sources suggests that the canal system is adapted to the frequency spectrum of movements characteristic for particular locomotor behaviors by changes in the radii of curvature of the membranous semicircular ducts. The size of these ducts can be estimated from that of their bony canals in the petrous bones of extant and fossil crania. A strong link between locomotor patterns and semicircular canal size in extant primates would provide powerful tests of inferred locomotor behavior in extinct species independent of those inferred from their postcranial skeleton.

The canal dimensions of 40 extant primate species were collected from CT scans and the literature. The overall trend shown by this sample is that, scaled against body mass, species showing rapid, high-frequency movements have larger canals than those showing more sluggish, low-frequency movements.

In addition to the extant species, semicircular canal dimensions of the giant subfossil lemur *Megaladapis edwardsi* from Madagascar were taken from CT scans, and the canals of the omomyid *Necrolemur antiquus* and the adapid *Adapis parisiensis* from the Eocene of France were assessed by the relatively new micro-CT technique. The dominant locomotor behaviors previously inferred from postcranial bones are, respectively, koala-like climbing, vertical clinging and leaping, and either a loris-like or monkey-like quadrupedalism. These hypotheses can now be evaluated using the comparative framework of canal dimensions in the extant primate sample.

Topographic effects on measures of monkey habitat-use in a mountainous study site in Japan. D. S. SPRAGUE, Institute of History and Anthropology, University of Tsukuba, Tsukuba 305, Japan.

Primatologists working in mountainous habitats may need to account for the effects of topography on the data used to describe habitat-use in primates. Primatologists often record the location or travel routes of their study subjects on a flat map. These data then may be used to measure day-travel length or

calculate a home-range area, often without regard for topography. However, mountainous topography increases values of distance and area compared to those obtained from a flat map. Topography may affect research results if the subject animals live in highly variable topography.

This study investigated how topography affected measures of travel distance and home range area with a sample of travel route data on study troops in the Yakushima study site of Japanese macaque (*Macaca fuscata yakui*) using a geographical information system. Travel distance and home-range area for three troops were calculated first on a flat map. Then they were recalculated after draping travel routes and home-ranges on a digital elevation model. Distances and areas both increased to slightly differing degrees for each troop.

Optimal birth spacing in a 19th century Mennonite community. D.A. ST GEORGE, J.C. STEVENSON, P.M. EVERSON, L.M. TEDROW, Western Washington University, Bellingham, WA 98225-9083.

Blurton Jones argues that the optimal birth interval in Bushmen foragers is 48 months due to excess mortality at shorter intervals which he attributes to the costs required to carry infants and their food. Increased sedentism and the resulting Neolithic population increase surely reflects a change in that optimum, and examination of birth intervals in an agricultural society may partially elucidate the nature of the change. The focus here is on a 19th century, naturally fertile, Mennonite church congregation.

Cox's regression analyses were performed on genealogical data derived from church registries for 381 women and 2418 births during 1825 to 1925. Shorter birth intervals correlate with an increased risk of infant and early childhood mortality (up to 5 years of age), but interval-mortality correlation varies according to effective fecundability. High effective fecundability women (HEFs), 10+ births, show an interval-mortality correlation only at intervals less than 24 months. Low effective fecundability women (LEFs), less than 10 births, have interval-mortality correlations at intervals greater than 30 months. If effective fecundability is due to variable fertility, no interval-mortality correlation in longer intervals would be expected. This suggests that the variation in effective fecundability is a function of unrecorded excess fetal loss and that the interval-mortality correlation is a function, in large measure, of pregnancy alone.

An optimal birth interval of about 17 months, yielding 11.3 surviving children over a 20 year reproductive span, was calculated using hazard rates derived from models for the HEF group. Shorter intervals are associated with excess mortality. A 12 month interval yields 10.5

surviving children. Longer intervals result in fewer births.

Such a relatively short optimum (at the cost of 20–25% maternal mortality during the reproductive span) may support several of the hypothesized explanations for the Neolithic population increase including: increased coital frequency, reduced dependence on breastfeeding, and more social support during times of stress.

Morbid Osteology: Osteological Evidence for Post Mortem Procedures from Newcastle Infirmary Burial Ground (1753-1845)

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Skeletal material consisting of over two hundred articulated burials, and a large disarticulated collection made up from various contexts representing approximately 400 people, was excavated from Newcastle Infirmary Burial Ground during the winter of 1996-97. Burial at the Infirmary commenced in 1753 and concluded in 1845. Skeletal evidence for post mortem procedures has never been recovered on this scale before with over 70 craniotomies, several tibial prosection preparations and cuts to other skeletal elements represented. The Infirmary Burial Ground has produced irrefutable primary physical evidence that autopsy and dissection were practised in a provincial pauper hospital long before the passing of the Anatomy Act of 1832. Unlike the majority of previously excavated post-Medieval British skeletal collections which consist largely of the middle or upper classes, the patients at Newcastle Infirmary were from poorer sections of society. Their choice as subjects for post mortem procedures is compatible with contemporary documentation and modern medical historical research. Large portions of the burial register from the Infirmary are extant, as are contemporary autopsy reports. These allow a rare opportunity to compare historical descriptions of post mortem procedures to physical osteological evidence. Macroscopic anatomical and osteological techniques were used to record the skeletal evidence for post-mortem procedures and associated pathological lesions. Location, direction and depth of cut and knife marks were analysed to reveal patterns which implied precise post mortem procedures comparable to contemporary autopsy reports. The skeletal material revealed practises associated with learning and teaching about the human body and disease which forms the basis of modern medical anthropology.

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Everyone's doing the population shuffle: prehistoric population movement in west-central Illinois.
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West-central Illinois provides a natural laboratory for the study of a number of parameters of prehistoric lifeways, including settlement distribution and microevolutionary processes that shape population structure. In this study, a regional perspective was adopted to investigate changes in spatial patterns of biological interaction over time coincident with major cultural, economic and sociopolitical changes. Relethford and Blangero's population genetics model of within-group heterozygosity, specifically modified for use with cranial measurements, was used to detect patterns of large- and small-scale population movement over time in Late Woodland (A.D. 700-1100) and Mississippian (A.D. 1000-1400) populations from the central and lower Illinois valleys and the central Mississippi valley. The relatively less sedentary Late Woodland people had a larger sphere of biological interaction without regard for geographic distance than did the Mississippian horticulturalists. In the Mississippian period, culturally imposed barriers paralleled geographic boundaries between regions such that the distribution of sites and biological variation closely adheres to a classic isolation by distance model. Intraregional redistribution of sites and populations was a more important process than interregional gene flow in shaping Mississippian population structure. This small-scale shuffling among Mississippian groups in west-central Illinois is wholly consistent with other recent studies of Midwest and southeast prehistoric biocultural and geographic landscapes.

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A health index from skeletal remains. RICHARD H. STECKEL, Economics and Anthropology Departments, Ohio State University, Columbus, OH 43210; JEROME C. ROSE, Anthropology Department, University of Arkansas, Fayetteville, AK 72701; PAUL SCIULLI, Anthropology Department, Ohio State University, Columbus, OH 43210.

Traditional measures employed by economists and other social scientists, such as Gross National Product per capita, are unavailable and of doubtful validity for studying very long-term trends in the quality of life. This paper merges ideas from economics, history, and anthropology with skeletal data to measure health aspects of the standard of living in the Western Hemisphere from pre-Columbian times to the early twentieth century.

The first task was to construct a data base, a project begun by creating a common reporting format for skeletal data produced by 15 research teams. The categories of chronic biological stress used in this project include stature, degenerative joint disease, hypoplasias, tooth loss, anemia, trauma and infections. The data were pooled to create a data base of 12,500 individuals from various ethnic groups at 218 sites throughout the Western Hemisphere.

Drawing inspiration from the field of medical economics, we then created a procedure for measuring health from the 7 categories of stress noted above. This health index weights the categories of stress equally and is based on length of life and the quality of life while living, as determined from skeletal remains.

The results show wide variations in health status, in which Native Americans were among both the healthiest and least healthy. A moderate decline in health occurred in the millennia prior to the arrival of Columbus. American slaves were near the bottom of the rankings, registering indicators of chronic stress comparable to Native American populations threatened with extinction.

We hope this Mark I version of the index will be improved through subsequent research and interaction with the profession.

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A field test of work capacity: Ifugao rice farmers. A. F. STEEGMANN, JR. Anthropology, SUNY Buffalo, NY 14261 and S.J. HEWNER, HSA, D'Youville College, Buffalo, NY 14213.

Recent research on Chinese cycle haulers showed that their economic productivity was not strongly related to aerobic capacity. Since hauling is a physically demanding occupation, this lack of relationship is an unsettling finding. It raises questions about the importance of biological factors as predictors of economic output, and this is critical if output is a key to our well being.

Here we report a further exploration of the problem in a community of mountain rice farmers - an Ifugao village in the Western Cordillera of Luzon, the Philippines. This subsistence economy depends on intensive irrigation terrace rice farming, plus household gardens and swiddens. Heavy carrying, stoop labor and climbing are required of all and little animal or machine aid is seen.

We completed a field test of work capacity on 30 male farmers ranging in age from mid-teens to mid-50s. It involved a self-paced walk from the valley floor, up the mountain wall and return, with heart rate monitoring. The route was over two kilometers with a vertical increase of about 173 meters. At its steepest, the grade was about 34 degrees, requiring long runs of steps cut into the mountainside. The analysis relates a work capacity measure (heart rate/speed) to motivation, anthropometry, health status and a range of household/social factors. We conclude with comment on the complexity of measuring agricultural productivity and how productivity relates to the other variables.

Craniometric Variation and Homogeneity in Prehistoric Rapa Nui (Easter Island) Regional Populations. V. H. STEFAN, University of New Mexico, Albuquerque, NM 87131

The existence of two main tribal confederacies on prehistoric Rapa Nui, the *Tu'u* and *Hotu'iti*, has been noted by Métraux (1940), and the tribes within them are known to have occupied distinctly separate areas. Discrete cranial morphological traits of prehistoric and protohistoric Rapa Nui islanders have been examined and have illustrated distinct regional or tribal differences; however, craniometric traits have not been extensively evaluated to determine if similar regional population differences exist. This study examines the range of variability of Rapa Nui craniometrics and utilizes populations genetic techniques to evaluate the level of homogeneity/heterogeneity within the island populations.

The data consist of 50 cranio-facial measurements of Rapa Nui skeletal material from the Late Prehistoric (1680-1722) and Protohistoric (1722-1868) periods. The sample was divided into five tribal regions: North, Northeast, South, Southwest and West. GLM statistical analyses revealed two variables significant for males and five for females across tribal regions. Significant sexual dimorphism was also demonstrated in all but a few variables. Darroch and Mosimann size adjusted variables were not significantly different across the five tribal regions at the $\alpha=0.05$ level, and only three were significant at the $\alpha=0.10$ level. Discriminate function analyses utilizing crossvalidation provided classification error rates of 56.3% for males and 69.9% for females. Discriminant function analysis performed on the three size corrected variables which were significant at the $\alpha=0.10$ level, provided a classification error rate of 72.6% for the pooled male/female sample. Minimum F_{ST} values for males (0.2292) and females (0.2130) were calculated from unbiased Mahalanobis D^2 values.

These results indicate that significant craniometric differences between the tribal regions did not exist in prehistoric Rapa Nui populations, supporting the findings of previous research which have documented the homogeneity of the craniometrics of those tribal populations. However the calculated minimum F_{ST} values indicate the existence of slight levels of heterogeneity within the Rapa Nui regional populations resulting from genetic drift. This variation may reflect the establishment in prehistoric times of strict tribal boundaries and/or the practice of strict endogamous tribal marriage practices.

A new fossil platyrrhine femur from the Pinturas Formation of Argentina. N.J. STEVENS, Doctoral Program in Anthropological Sciences, SUNY at Stony Brook, Stony Brook, NY 11794, J.G. FLEAGLE, Anatomical Sciences, SUNY at Stony Brook, Stony Brook, NY 11794.

Paleontological discoveries at sites within the Pinturas Formation (early-middle Miocene, Santa Cruz Province, Argentina) have recently led to the identification of four new fossil platyrrhine taxa. These discoveries were made during ongoing collaborative work between the Museo Argentino de Ciencias Naturales in Buenos Aires, and the State University of New York at Stony Brook. This work has resulted in the recovery of many primate and

mammalian fossil specimens. Among these are numerous postcranial remains.

In this study, fossil femora are compared with the proximal femur in platyrrhine primates. The goals of this study are to place within this context the morphology of a newly discovered femur from the Pinturas Formation. Included in this comparison are a sample of modern platyrrhines, the Miocene primate taxa that preserve femora (*Homunculus* and *Cebupithecia*), and several other Patagonian fossil mammals of appropriate size.

Measurements useful in distinguishing primates, rodents, notoungulates and marsupials are identified. Our analysis places the new specimen in a cluster with platyrrhine femora, grouping most closely with *Homunculus*. On the basis of size and provenience, it is suggested that the specimen belongs to a species of *Carlocebus*.

Continued analysis of the cranial and postcranial remains of these taxa are useful in understanding not only the primates of this region during the Miocene, but also their implications for platyrrhine and mammalian evolution, and the paleoenvironment of this region as a whole.

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Allometric variability in the cross-sectional properties of the human femoral midshaft.

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The distribution of cortical bone in the diaphysis of the human femur should be highly correlated with body size, due to its relative plasticity and the effects of weight bearing during locomotion. The reconstruction of prehistoric behavior is contingent upon the understanding of this plasticity.

This study compares the cross-sectional geometric properties (CA, TA, I_{max}, I_{min}, J) of cortical bone at the femoral midshaft of two populations exhibiting small adult body size, against a population from the 19th century cemetery at St. Thomas' Anglican Church, Belleville, Ontario (n=226, $\sigma=130$, $\varphi=96$). The two small bodied populations are Later Stone Age (LSA) southern Africans dating from ca. 10,000 to 2,000 b.p. (n=14, $\sigma=3$, $\varphi=11$), and late 19th century AD indigenous Andaman Islanders (n=30, $\sigma=18$, $\varphi=12$). Estimated mean stature of the LSA population are below the third percentile of adult stature of the contemporary American population, while the Andamanese estimates fall below the first percentile.

Discriminant analysis of cross-sectional properties successfully differentiates individuals of the small-bodied populations from the larger Belleville population in over 90% of cases, while ca. 80% of cases are differentiated when femur length standardized properties are used. There is significant sexual dimorphism in all properties within each of the three populations, but it is proportionally most pronounced among the large bodied sample. Least-squares regression of logarithmic transformed data reveals substantial populational variability and sexual dimorphism in the relationship

between femur length and cross-sectional geometric properties. This relationship is roughly isometric when the three populations are considered simultaneously.

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Bone by bone, pueblo by pueblo: reviewing the evidence for treponemal infection in the prehistoric Southwest. A.L.W. STODDER, Department of Anthropology, Field Museum of Natural History, Chicago, IL 60605.

This study presents a systematic collation and evaluation of the extant data on treponematoses in the prehistoric Southwest. The literature on Southwestern paleopathology and bioarchaeology includes descriptions of skeletal pathologies attributed to treponemal infection in assemblages from at least 14 different archaeological localities. The reported cases are from sites with Mogollon, Hohokam, and Anasazi cultural affiliations, with dates ranging from Basketmaker through the early historic period. The literature itself spans a broad time range as well; publication dates extend from 1923 to 1996.

Regional, temporal and observer-based variation are all apparent in the regional data set. Some reports describe a single affected skeletal element with lesions attributed to syphilis, others describe treponemal syndromes based on patterns of lesion types and their distribution, observed at the population or community level. A fundamental question posed by the data is whether the apparent absence of treponemal infection in the vast majority of Southwestern skeletal assemblages is an artifact of under-reporting, trends in differential diagnosis among paleopathologists, or whether the negative evidence suggests culturally or environmentally-based variation in the epidemiology?

Does the current literature on skeletal remains allow us to distinguish between different treponemal diseases based on clinical models, and do the skeletal data support the contention of Rothschild et al. (1995) that yaws was transformed into syphilis in the Southwestern United States? What was the impact of treponemas on the health of prehistoric people in the Southwest, and how did this infection interact with other endemic conditions like tuberculosis?

These questions represent various dimensions of the investigation of the history of treponemal-human interaction, which must be reconstructed at the local, regional and global scales.

The average preservation index: Methodology and application on a Florida wet site. C.M. STOJANOWSKI, Anthropology, University of New Mexico, Albuquerque, NM 87131 and R.M. SEIDEMANN, Geography and Anthropology, Louisiana State University, Baton Rouge, LA 70803.

Skeletal preservation is currently dealt with in brief, qualitative terms where the integrity of bone in a sample is

characterized as poor, fair, good, etc. This may create problems for the paleodemographer as age and sex specific preservation biases result in inaccurate demographic reconstructions. We introduce a method for developing a quantitative index of skeletal preservation for a given sample based on the presence or absence of 95 sexing or aging diagnostic features. For immature individuals, 76 features are observed. This method considers cranial, postcranial, and dental elements excluding only the ribs, vertebra, carpals, tarsals, metatarsals, and metacarpals. Elements of limited utility for sex and age determination.

Each individual in a sample is evaluated for completeness based upon these criteria using a binary scoring system. The number of present features is divided by 95 for adults and 76 for subadults to determine the Individual Score for each individual. After the entire skeletal series is evaluated, the descriptive statistics are calculated for each of the following: total sample, males, females, adults, and subadults. The mean for the total sample is the Average Preservation Index (API) for that series. This figure represents the quantitative expression of the preservation condition of a sample.

This methodology was tested on the Windover skeletal series (8BR246). Previous descriptions of the condition of these remains include: "superb preservation", as well as "extremely variable". Such statements are virtually meaningless and give no indication of variation by age or sex. The results of this analysis indicate that a wide range of API scores was present in the Windover sample, ranging from .034 to .945 with a mean of .510 ($n=105$, $sd=.213$). A t-test comparing sex specific variation ($t=.122$, $df=67$, $p=.904$) indicated that no preservation biases were present for this sample. An analysis of covariance indicated that age at death was poorly correlated with degree of preservation (squared multiple $R=.016$).

Y chromosome variation in *Pan*

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Although several recent studies have examined mitochondrial DNA (mtDNA) variation in *Pan troglodytes*, the investigation of Y chromosome variation in this species and in *Pan paniscus* has been limited. We are searching for variation in the non-recombining portion of the Y in order to examine the phylogeny of the genus *Pan*, and, in particular, to investigate population history and substructure within the currently defined species.

Three short tandem repeat (STR) loci, and three single copy regions are being investigated. The three STR loci, DYS388, DYS390 and DYS391, were first discovered in humans. Of these, we have found that two are highly variable in *P. troglodytes* while one is monomorphic. The three single copy regions are non-

coding and approximately 3.5 kb in total. Numerous substitutions have been found in these sequences between *P. troglodytes* and *P. paniscus*, and we are currently using denaturing high performance liquid chromatography (DHPLC) to find polymorphic sites within species.

This study is supported by a small grant from the University of Arizona.

The peopling of Sahul: a genetic perspective. M. STONEKING and A.J. REDD, Department of Anthropology, Pennsylvania State University, University Park, PA 16802.

The origins and affinities of Sahulian (aboriginal Australian and New Guinean) populations remain obscure. Various hypotheses have been proposed as to the number, source, and timing of human migrations to Sahul. Most genetic studies find that Australian and New Guinean populations are most closely related to one another, consistent with a single major occupation of Sahul. However, previous mtDNA studies have shown a closer affinity of Australian and New Guinean populations with Southeast Asians than with each other, contradicting the simple hypothesis of a single origin of Sahulians.

To further clarify these issues, we have undertaken a comprehensive study of molecular genetic variation in aboriginal Australian, New Guinean, and Indonesian populations. Individuals from two Australian populations, one New Guinean highland population, and two eastern Indonesian populations were analyzed for four genetic systems: mtDNA, Y-chromosome short-tandem-repeat (STR) loci, Alu insertion polymorphisms, and HLA class II loci. We will present the results of our analyses of these genetic data, with particular emphasis on the degree of concordance among the various genetic systems, which will indicate the reliability of the genetic data for making inferences about the peopling of Sahul.

Complex societies and social disruption: What skeletons reveal about Mesoamerican prehistory. R. STOREY, Dept. of Anthropology, University of Houston, Houston, TX 77204-5882, and L. MARQUEZ MORALES, ENAH, Col. Isidro Fabela, 14030 Mexico, D.F. Mexico.

Four skeletal samples from Central Mexico and four samples from the Mayan area of the Yucatan and Honduras were studied as part of a large comparative database on skeletal indicators of health and lifestyle in the Western Hemisphere. The information on porotic hyperostosis, enamel hypoplasias, and periosteal reactions, with other indicators, was used to investigate several problems in Mesoamerican prehistory. Only two will be discussed here.

In Central Mexico, skeletons from an early agricultural village are compared with urban samples from three Pre-Columbian centers. While the urban samples do not uniformly have higher frequencies of the health indicators than the village, the frequencies do record a general in-

crease in chronic stress and illness that accompanied greater population densities and status inequalities as these societies evolved from horticulturalists to states based on intensive agriculture and economic specialization.

For the Maya, two samples from the important center of Classic Maya civilization, Copan, are compared with two contemporary samples from coastal Yucatan. Copan was one of the centers abandoned as part of the Classic Maya collapse. The frequency of the health indicators is higher at Copan than at the Yucatan sites that were not part of the Classic Maya collapse, indicating the increased chronic stress on both elites and commoners that accompanied the collapse of the Copan polity and society.

This exercise does support the use of skeletons to complement other information available for these societies to enrich our understanding of the Mesoamerican past and to contribute to the comparative study of humans in various cultural situations. Within the Western Hemisphere database, these skeletal samples appear to be among the ones with the poorest quality of life. Living with chronic stress was common in these prehistoric complex societies.

Presence of dental enamel hypoplasia in wild-shot chimpanzees (genus *Pan*) and gorillas (genus *Gorilla*)
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Dental enamel hypoplasia is one pathology that has been increasingly utilized as a marker of non-specific stress in both modern and prehistoric hominid populations. In comparison, however, minimal research has been presented concerning the presence of dental enamel hypoplasias in chimpanzee (genus *Pan*) and gorilla (genus *Gorilla*) dental remains, despite the benefits of this non-evasive approach to the study of the health and growth of great apes in the wild. For this poster 98 chimpanzee and 229 gorilla dentitions were observed for evidence of enamel hypoplasia. The specimens are part of the Hamann Collection of great ape skeletal remains housed in the Cleveland Museum of Natural History, of which the majority were wild-shot during the first quarter of the 20th century. Of the specimens included in this study, 143 of the gorillas are male, 86 female. The chimpanzee sample includes 36 males and 62 females. Details concerning the location and severity of distinct enamel hypoplasias were recorded, as was information regarding individual dental wear. Preliminary analysis reveals a marked dichotomy of hypoplastic expression between the two taxa, with the chimpanzee sample exhibiting a higher frequency (80.6% of individuals) of singular and multiple hypoplastic events as compared with the gorilla specimens (27.5% of individuals). As expected, a negative correlation between severity of dental wear and number of hypoplasias is demonstrated. Differences in the number and chronology of enamel hypoplasias, and thus,

indicators of physiological stress between the chimpanzee and gorilla samples, may be due to the dissimilar availability of preferred dietary sources among the taxa.

Morphological integration in the hominid cranial base: implications for early hominid phylogeny. D.S. STRAIT, Department of Anthropology, 2110 G Street, NW, The George Washington University, Washington, DC 20052.

Basicranial features relevant to hominid evolution were used to demonstrate the importance of morphological integration to phylogenetic (cladistic) analysis. Integrated characters are those that are so highly functionally, structurally or developmentally related to each other that they evolve as a unit. Such characters violate the assumption of character independence that is implicit in all cladistic studies. Accordingly, hypotheses purporting to explain the functional and structural relationships of basicranial features were tested, and complexes of integrated characters were identified. These complexes were then treated as if they were single characters in a cladistic analysis of early hominids.

Twenty-two facial, neuro- and basicranial measurements were taken on crania from 35 catarrhine species, including *P. africanus*, *A. africanus*, *P. boisei*, *P. aethiopicus* and *H. habilis*. These measurements were supplemented with body mass data and one measure of neck posture (in extant taxa). Matrix comparisons were used to test functional/structural hypotheses that relate basicranial features to either brain size, neck posture, allometry, facial prognathism, mastication, or developmental constraint. Image factor analysis was then used to find groups of highly inter-correlated characters that may represent integrated complexes. Complexes were defined, and then weighted as if they were single characters in a cladistic analysis of early hominid basicranial features.

Matrix comparisons found that many functional hypotheses explained patterns of basicranial variation, but they predicted such similar patterns of character correlation that no single hypothesis was favored over any other. However, factor analysis found that four characters (external cranial base flexion, inclination and position of the foramen magnum, nuchal plane inclination) were highly structurally related to each other, and in hominoids were related to relative brain size and the size of the temporonuchal crest. Grouping these features into complexes in a cladistic analysis affected the phylogenetic relationships of *A. africanus*, a species whose relationships are controversial. Thus, a consideration of morphological integration may influence interpretations of early hominid phylogeny. Recent analyses of early hominid phylogeny have emphasized the importance of character complexes, and it is clear that studies of integration are needed on all cranial regions.

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Fecundability and husband's age among the Dogon of Mali. B. I. STRASSMANN¹ AND J. WARNER², ¹Dept. of Anthropology, Univ. of Michigan, Ann Arbor, MI 48109, ²Dept. of Statistics, Univ. of Michigan, Ann Arbor, MI 48109

Demographers usually disregard the effect of husband's age on fecundability on the assumption that it is small in

relation to the effect of wife's age and other covariates (Goldman and Montgomery 1989). We tested this assumption by including husband's age as a covariate in a study of effective fecundability among the Dogon of Mali. The Dogon are particularly suitable for the study of fecundability because during menses Dogon women visit a menstrual hut, a custom that made it possible to monitor the waiting time to conception prospectively without interviews. Hormonal data confirmed that menstrual hut visitation is a reliable indication of menstruation (Strassmann 1996). Although our window of observation was two years long, the conception waits for only 15 of the 58 women were completely observed. To handle the problem of censored data, we used survival analysis (both discrete and continuous time). The results indicate that husband's age was a significant predictor of fecundability, even after controlling for the other significant predictors: wife's age, marital duration, gravidity (number of prior pregnancies), and breastfeeding status. Specifically, if the husband was younger than 35 years, the relative risk of conception was 7.3 ($p = 0.005$) compared with couples in which the husband was 50 years or older. When the husband was 35 to 49 years, the relative risk of conception was 4.0 ($p = 0.04$) compared with couples in which the husband was 50 years or older. The decline in fecundability with husband's age may be due to lower coital frequency, deteriorating health, and reproductive senescence, all of which are inter-related. Our results support the suggestion of Campbell and Leslie (1995) that human reproductive ecologists need to pay closer attention to the male contribution to reproduction.

Morphological distinctiveness of Nigerian gorilla crania. R.M. STUMPF, J.G. FLEAGLE, W.L. JUNGERS, SUNY at Stony Brook, Stony Brook, NY 11794; J.F. OATES, Hunter College, CUNY, NY 10021; and C.P. GROVES, Australia National University, Sydney, Australia.

A study by Groves (1970) of the morphological variation in the crania of different *Gorilla* populations led to the presently accepted taxonomy consisting of three subspecies: the western lowland gorilla (*Gorilla gorilla gorilla*), the eastern lowland gorilla (*G.g. graueri*), and the mountain gorilla (*G.g. beringei*).

A previous reanalysis of Groves's (1970) results, based on raw and size-adjusted data, supported Groves's 1970 classification, yet found notable differences in the Nigerian population. This study examines the extent to which Nigerian gorillas differ from other gorilla populations. Using canonical variates analysis on 19 measurements from 504 gorilla crania representing 19 geographic populations of *Gorilla*, results indicate that the Nigerian population differs significantly from each of the eastern subspecies, and from other western lowland gorillas.

Nigerian males differ from their western lowland counterparts in having proportionally greater orbital heights, nuchal surface and orbital breadths, with proportionally smaller interorbital breadths. Nigerian females have proportionally greater orbital, nasal, and nuchal surface breadths, with shorter subnasal regions than other western lowland gorillas.

Pairwise comparisons were made between the 19 *Gorilla* populations using Mahalanobis distances, which reflect the morphological differences between

groups. Nigerian males were significantly different from all other populations in all comparisons, and Nigerian females differed significantly in 92% of the comparisons. Only the Virunga volcano mountain gorilla population and some eastern lowland gorilla populations were this distinct in as many pairwise comparisons. Mahalanobis distances between males of the Nigerian population and males grouped from all remaining western lowland populations rival the Mahalanobis distances between eastern lowland and mountain gorillas, which are currently considered separate subspecies.

The morphological distinctiveness of the Nigerian gorilla population noted here parallels the findings of recent studies on the genetic distinctiveness of Nigerian chimpanzees. Clearly the systematic and conservation status of the Nigerian apes deserves further consideration.

Locomotion and forelimb morphology in snub-nosed monkeys (Colobinae: *Rhinopithecus*). D. SU, University of California, Berkeley, CA 94720, and N. G. JABLONSKI, California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118.

The Chinese species of snub-nosed monkeys are large-bodied colobines that inhabit a range of forest types from evergreen and deciduous broadleaf forest at 1500 to 2200 m (*Rhinopithecus [Rhinopithecus] brelichi*) to deciduous broadleaf and coniferous forest at 1200 to 3000 m (*R. [R.] roxellana*) to evergreen broadleaf and coniferous forests above 3000 m (*R. [R.] hietii*). Observations of locomotor behavior in these species conducted by W. Bleisch (for *R. [R.] brelichi*) and R. C. Kirkpatrick (for *R. [R.] roxellana* and *R. [R.] hietii*) indicate that many of the animals' locomotor behaviors involve traction of the forelimb. In young juveniles, overhead suspensory locomotion is common. As body mass increases during ontogeny, arm-swinging is replaced by a pattern dominated by quadrupedal climbing and leaping. As adults, the climbing of vertical or near-vertical substrates of large diameter, involving the consistent reaching of the forelimb above the level of shoulder, occurs frequently. This activity thus replaces arm-swinging during ontogeny as the behavior involving the most traction of the forelimb and apparently generating the highest tensile strains.

Comparisons of the scapular and forelimb long bone morphology of the Chinese *Rhinopithecus* species were made against other colobines (*Nasalis*, *Pygathrix*, and some *Trachypithecus* and *Presbytis* species) and selected species of the cercopithecae genera *Macaca* and *Cercopithecus*. Comparisons of the relative sizes of the supra- and infraspinous fossae, the marginal thickenings of the scapular blade and spine, and of morphometric values of the spinoglenoid, axilloglenoid and axillospinal angles of the scapula, the orientation of the glenoid fossa, the medial extent of the trapezius muscle insertion on the scapular spine, the relative length of the trapezius-serratus anterior couple arm, and the robustness indexes of the forelimb long bones were undertaken. The results show marked morphological and morphometric similarities between the Chinese snub-nosed monkeys and the other "odd-nosed" monkeys, *Nasalis* and *Pygathrix*, known to exhibit similar patterns of locomotion. This locomotor repertoire and these morphologies differ from those seen in Asian leaf monkeys and, in particular, from those seen in arboreal quadrupedal macaques and cercopitheques.

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Hand function and tool behavior in early hominids. R.L. SUSMAN, University at Stony Brook, Stony Brook NY 11794.

Description of hand fossils of early hominids from South and East Africa has sparked debate on the question of how we discern tool behavior in the fossil record. Napier provided valuable insights into the evolution of tool behavior in early Homo in his enduring study of the OH 7 hand. More recently, fossils of Paranthropus and other species have provided additional clues of precision and power grasping in early hominids. My results indicate that not only Homo, but also Paranthropus robustus was a tool maker. Australopithecus afarensis does not show signs of human-like precision grasping.

Marzke (AJPA 102:91-110, 1997) has taken issue with my conclusions and has questioned the diagnostic value of features suggested by Napier and me to be indicators of hominid tool behavior. In addition to her criticism, Marzke offers some of her own suggestions on how to diagnose tool behavior. However, six of the eight traits proposed by Marzke to be indicative of tool behavior were discussed previously by Napier and others. Two novel traits offered by Marzke as evidence of precision grasping, viz., 1) the presence of ungual spines on the distal phalanges, and 2) orientation of articular facets on metacarpal II, fail to distinguish tool makers from others. In fact, ungual spines are found in baboons and other monkeys and thus their presence cannot indicate tool behavior. The assessment of the carpometacarpal joints of digit II is not presented by Marzke in a manner that allows comparison within, or across, species.

Marzke's analysis (and some of her methods) do not survive comparative and functional scrutiny. There is no compelling reason, at this time, to abandon the approach of Napier and his successors, to interpreting the fossil record of hand evolution.

Methodological Issues for
Gradient Phenomena Research
D. SWARTZ New York University

Data from 692 skeletons from virtually all primate genera produced significant positive bivariate correlations among dorsoventral broadening, craniocaudal "steepening", and the intermembral index in controlled comparison groups composed of individual specimens. Nearly 50% of all correlations were significant; 70% of all groups produced at least one significant correlation. Short-tailed species have extra sacra and form a class of outliers which lower r values and may

impede attainment of significance. Low coefficients of variation may also underlie failures to attain significance.

Significant results were not interpreted as *prima facie* evidence of gradient interactions, but analyzed for patterning by phylogeny, taxonomic rank, weight, and several functional adaptations. The results could not be explained by any one factor, but were not explained solely by gradients. The evidence suggested that gradient interaction is a component of form, constraining adaptation and constrained by adaptation and phylogeny.

Statistical issues raised are addressed as follows. Use of Pearson's r , even for nonlinear distributions, permitted analysis of ratio scale data without arbitrary definition of ranks, only biasing the results from curvilinear distributions towards the null hypotheses. Nonnormal distributions simply indicated trends. Log transformation of ratio variables, while useful, was not vital to the analysis. Nonindependent tests over the range of taxonomic ranks were necessary, but independent tests at each rank were also compared. New analyses using group means as data points reduce inflated degrees of freedom and test for bias from phylogenetic constraint. Sufficient evidence for gradient interactions persists and can not be dismissed as spurious.

Paleodemography of the Poole-Rose Ossuary. R.G. TAGUE, M. MANHEIN and H. MCKILLOP, Department of Geography & Anthropology, Louisiana State University, Baton Rouge, LA 70803.

The Poole-Rose Ossuary, excavated in 1990 at the request of the Alderville First Nation, is a Late Woodland, Iroquoian burial site in southern Ontario, Canada. The site is dated by radiocarbon to A.D. 1550 \pm 50 years. Archaeological evidence suggests that the Poole-Rose population predates European contact.

The Poole-Rose Ossuary likely represents the mass ritual burial known as the "Feast of the Dead." The Feast was held approximately every 10 years, and the individuals interred in the ossuary would have been genetically closely related. However, the skeletal material is commingled, which complicates analysis and interpretation. This study reports on the demographic profile and sexual dimorphism of the Poole-Rose population.

The demographic profile is based on the hipbone. The auricular surface of the ilium and the pubic symphysis are used in age determination; the pubis, sciatic notch, and preauricular area are used in sex determination. The results show the minimum number of

individuals is 242. Of this number, approximately 24% are less than 15 years of age. Among adults, there is approximately an equal number of males and females, and the sex-specific mortality profiles are comparable. However, the demographic profile of the Poole-Rose Ossuary differs from that of other Iroquoian ossuaries. The significance of the intersite heterogeneity in demographic profiles is discussed. Finally, sexual dimorphism of the adult hipbone and femur is evaluated.

New fossil specimens of *Branisella boliviana*: evidence for a primitive platyrrhine. M. TAKAI¹, F. ANAYA², N. SHIGEHARA¹, and T. SETOGUCHI³. ¹Primate Res. Inst. Kyoto Univ., Japan. ²Museo Nacional de Ciencia Naturales, La Paz, Bolivia. ³Dept. of Geology, Faculty of Science, Kyoto Univ., Japan

Branisella boliviana is the oldest fossil platyrrhine yet discovered from the latest Oligocene deposits of Salla, northwestern Bolivia. Since the first specimen was described in the 1960s, very few were discovered until the 1980s. During the past 10 years, however, many specimens have been discovered at Salla, providing us with much information about the evolution of early platyrrhines.

During our 1996 field season, new fossil materials, two nearly complete mandibles and one upper jaw fragment, were collected at Salla. A maxilla and one mandible belong to the same individual, and another mandible is of an old monkey. Those specimens show the following morphological features of *Branisella*: mandibular arcade is nearly V-shaped; lower spatulate incisors are not anteriorly protruding and the lateral incisor is obviously larger than the medial one; the mandibular corpus is rather shallow but robustly wide; upper P2 is remarkably small; anterior zygomatic root protrudes smoothly from the maxilla; an orbit is not extremely large as seen in the extant *Aotus*.

The other mandibular specimen with badly worn teeth shows a remarkable trait at the mandibular symphysis. On the anterior face of the mandibular symphysis a straight "suture line" is observed. Since this "suture line" is not observed at the posterior side, it is not clear whether it is real or only a crack. However, an incompletely fused mandibular symphysis seen in some extant prosimians suggest the possibility that *Branisella* may be among the earliest fossil platyrrhine with an unfused mandibular symphysis.

Comparison of food passage time in three species of *Hapalemur*. C.L. TAN. Doctoral Program in Anthropological Sciences, State University of New York, Stony Brook.

Bamboo lemurs (genus *Hapalemur*), represented by three extant species, range in body size from 0.8 kg *H. griseus* to 2.6 kg *H. simus*. Although over 90% of their natural diet consists of bamboo materials, their gastrointestinal tract lacks the enlarged caecum seen in other highly folivorous prosimians (eg. *Avahi* and *Lepilemur*).

Food passage (the flow of digesta through gastrointestinal tract), measured by the rate of digesta transit, can be obtained via marker substances. To understand the relationships between diets and rates of food passage, markers were used to label the ingesta of three *Hapalemur* species (*H. simus*, *H. aureus*, and *H. griseus*). This study constitutes the first comparative passage time study of three *Hapalemur* species.

Four consecutive feeding trials were conducted on two adults (a male and a female) of each *Hapalemur* species housed at Parc Tsimbazaza, Madagascar. In addition to their usual zoo diets of locally grown bamboo (*Bambusa vulgaris*) and market produce, these lemurs were given bamboo shoots collected from southeastern Madagascar. During the experiment, each animal ingested approximately 30 color-coded soft plastic markers along with cucumber or banana slices. Food passage time (i.e. transit time) was determined by the first appearance of markers in the animal's excreta.

Transit time (hour) was shortest in *H. simus* (mean = 8.8 ± 1.0 , n = 8) while for *H. aureus* and *H. griseus*, transit times were three times as long (mean = 24 ± 1.8 , n = 5 and 27.6 ± 6.6 , n = 6, respectively). Previous food passage studies of *H. simus* and/or *H. griseus* reported similar results using different marker substances. These results also suggest that the three *Hapalemur* species differ in their capacities to utilize fibrous carbohydrates. The strategy employed by *H. simus* strongly resembles that of pandas, with an emphasis on bulk and roughage consumption and minimal fermentation. *H. aureus* and *H. griseus*, in contrast, feed on less fibrous bamboo parts; they reduce the bulk of ingesta by finely grinding food particles, hence increasing their fermentative capacity. Variations exhibited in bamboo lemurs' passage time, therefore, may have important implications for their dietary and physiological adaptations and the partitioning of their niches.

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Craniometry of Pacific Coast Athapaskans and population relationships along the North Pacific Coast. G. L. TASA, Oregon State Museum of Anthropology, University of Oregon, Eugene, OR 97403.

Athapaskans have played a major role in current hypotheses concerning the peopling of the New World (cf. Brennan and Howells 1976; Ossenberg 1994; Turner 1971, 1983, 1985, 1986) but skeletal samples are composed primarily of Desert Southwest Athapaskans and Athapaskans from the interior of Alaska. Approximately one thousand years ago, Athapaskans of the Alaskan or Canadian subarctic migrated southward into southern Oregon and northern California, occupying both the coastal margins and interior uplands of these areas at the time of contact. A

craniometric analysis of a sample of 66 skeletons primarily from three Late Prehistoric/Protohistoric Pacific Coast Athapaskan sites located along the southern Oregon coast was undertaken. This data was used to evaluate local population history and to further our understanding of Athapaskan craniometry.

Comparisons with local non-Athapaskan populations indicate that Pacific Coast Athapaskans have a longer history in northern California than in Oregon. Results also indicate that Pacific Coast Athapaskans most closely resemble the Tlingit of southeastern Alaska over other biologically known Athapaskan populations (Apache, Navaho, Alaskan Athapaskans). This suggests that Pacific Coast Athapaskans derive from Athapaskan groups closely abutting the Tlingit (the Tahltan, Tagish, or Tsetsaut) supporting archaeological and linguistic evidence concerning Pacific Coast Athapaskans. Results also confirm the close relationship between Aleuts and Na-Dene peoples as noted by other researchers.

Temporal trends in health indicators among Ohio Valley Native Americans. N.E. TATAREK and P.W. SCIULLI, The Ohio State University, Columbus, Ohio 43210

We present data relating to indicators of general health, including dental pathology, growth and stature, trauma, degenerative joint disease, hyperostosis, and periosteal reactions for a series of Native American populations from the Ohio Valley region. The time span considered is Late Archaic (ca. 3000 BP) to Late Prehistoric (ca. 350 BP).

The patterns of occurrence and associations among the health indicators in the Ohio Valley populations suggests that while stress was present it was not elevated. In most samples adults were relatively tall and the frequency of pathological conditions was low. The greatest difference in a health indicator is the increased frequency of dental caries among Late Prehistoric (ca. 1000-350 BP) maize agriculturalists.

These data indicate that during the 3500 year span considered the general life style of individuals within populations did not change significantly. Reasons for this general stability are discussed.

Differential diagnosis of periapical cavities in alveolar bone. N. TAYLES and G. DIAS. Department of Anatomy and Structural Biology, School of Medical Sciences, University of Otago, Dunedin, New Zealand.

Periapical cavities in alveolar bone are frequently described in the anthropological literature as 'abscesses' or 'abscess cavities'. However, an abscess will not create a bony cavity which is visible to the naked eye and therefore this

diagnosis is not necessarily correct. Abscess formation is only one of a number of possible inflammatory responses to infection of the dentition and its supporting structures. The most common response is the formation of a granuloma (a mass of granulation tissue) and it is this chronic condition which stimulates the formation of a bony cavity. Over time, the granuloma may transform into a periapical cyst, with continued enlargement of the cavity. In the case of increased virulence of the infection or compromise of host immunity, these sites may provide a focus for the development of an acute abscess, which may become chronic. Differential diagnosis is based primarily on the condition of the walls and margin of the cavity. This would be smooth in the case of a granuloma, as the bone is remodelled during the development of the lesion. The margins of the cavity will be circumscribed and the diameter less than c. 3mm. A cavity with the same characteristics but larger than 3mm is most likely to be an apical periodontal cyst. If the walls are clearly roughened and the margins ragged it can be identified as an acute abscess developing secondarily within a granuloma or cyst. A bony sinus leading to the subperiosteal surface or into a maxillary sinus is diagnostic of a chronic abscess. Both granulomata and cysts are relatively benign, causing at the most minor, localised, discomfort. This compares with the localised severe pain together with systemic effects such as fever and general malaise which can be caused by an acute abscess. Although these symptoms are alleviated to some extent by the relief of pressure when the pus is drained and an abscess becomes chronic, describing all cavities as 'abscesses' suggests that the affected individuals were ill. If the cavities were all occupied by granulomata and/or cysts, the person may in fact have been quite unaware of their presence and would have felt well. Particularly in the not uncommon cases of individuals with multiple periapical cavities, the diagnosis has significant implications for the interpretation of their health.

Masticatory form and function in gorillas (*Gorilla gorilla gorilla* & *G.g. beringei*). A.B. TAYLOR. Department of Physical Therapy, Samuel Merritt College, Oakland, CA 94609.

This investigation examined maxillomandibular form and function in gorillas. Based on previous results of comparative morphological studies and *in vivo* experimentation on patterns of stress in the mandibular corpus during mastication, the folivorous mountain gorilla was predicted to exhibit adaptations of the masticatory complex to both resist the greater loads associated with the mechanical demands of a leafy diet and increase masticatory efficiency. These adaptations include relatively 1) deeper mandibles (vertically); 2) thicker mandibular symphyses (labio-lingually); and 3) higher temporomandibular joints.

Linear dimensions of the skull, mandible, and dentition were obtained on samples of adult *G.g. gorilla* (n=11) and *G.g. beringei* (n=8), including M₁ and M₂ mandibular corpus height and depth, symphysis height and depth, mandibular ramus height, length of the incisor row, and mesiodistal and buccolingual dimensions of P1-M3. ANOVA was used to test for significant (P < 0.05) differences in linear dimensions and indices between

subspecies, and PCA used to summarize patterns of subspecific variation.

Preliminary results indicate the two subspecies differ predictably in morphology as a function of dietary preferences. For example, when controlled for mandibular length, the mountain gorilla exhibits a significantly greater corpus height at M_1 , consistent with biomechanical expectations of a higher mandibular corpus to offset the sagittal bending stresses associated with balancing-side of the mandibular corpus during unilateral mastication. *G.g. beringei* also exhibits a significantly greater ramus height, suggesting the more folivorous mountain gorilla is characterized by a higher temporomandibular joint, which has been hypothesized to reduce the fatigue associated with frequent chewing cycles by more evenly distributing occlusal loads along the postcanine teeth.

Supported by a grant from Samuel Merritt College.

Behavior and Reproduction in Aged Lemurs. L.L. TAYLOR, Department of Anthropology, University of Miami, Coral Gables, FL 33124-2005

The behavior and reproduction in aged animals has been little studied in prosimians to date. More than 500 hours of focal animal sampling were gathered at the Duke University Primate Center on diurnal, socially-housed, aged lemurs and their younger cage mates. These data were used to test hypotheses concerning aging and social isolation. Reproductive histories were examined to determine whether or not there was any evidence of reproductive quiescence in the last trimester of life. Both aged and younger animals were overwhelmingly social, being scored in proximity to others 66% and 60.9% of samples respectively. Overall, aged animals were scored as being alone (not in proximity) more often (39.2%) than were the younger animals (33.9% of samples). Sex differences were apparent in that aged females on average were scored alone (35.6% of scores) less often than aged males (42% of scores). Likewise, younger females were scored alone in 26.7% of samples, in contrast to males of the same age (35% of samples). These data support the hypothesis that aged individuals are not as actively involved in the social life of a group in comparison to younger conspecifics. However, these findings are contrary to the prediction that female social isolation will not occur in matrilineal groups. In addition, advanced age did not diminish female feeding priority or dominance in any of the groups observed. Colony records showed that normal, healthy animals of both sexes continued to produce offspring throughout the life

span. Menopause may therefore be a trait unique to anthropoid primates.

This research was supported in part by a James W. McLamore award from the University of Miami.

Teeth as tools in the Late PPNB population from Nevalı Cori (Turkey). W.-R. TEEGEN and M. SCHULTZ, Zentrum Anatomie, University of Göttingen (Germany).

Amongst the mostly poorly preserved skeletons from the early neolithic settlement from Nevalı Cori (Turkey), dating around 8200 cal. BC, two cases with artificial tooth modifications were found. The skeletal material was examined by macroscopic, endoscopic, radiological, light and scanning-electron microscopic techniques.

The skulls belonged to two 45+ years old females (skulls "B" and "C"). They were found in a multiple burial with four individuals in house 21 in the oldest PPNB layer. The dentition in skull "B" was almost completely preserved, in skull "C", the dentition from the upper jaw was also well preserved. Both individuals showed transverse linear enamel hypoplasias (TEEGEN and SCHULTZ 1997). Both in the upper and lower dentition, thick grooves were present on the occlusal surface of the second incisors and the canines. They were directed in a labial-palatinal and a labial-lingual direction. The grooves resulted from using the teeth as tools. A similar case was reported by MOLLESON from the PPNB site Abu Hureira (Syria). In the Late PPNB population from Basta (Jordan) such alterations were not found (SCHULTZ et al. 1997, 1998).

In both skulls the first upper incisors were missing. Probably they had not been formed (congenital aplasia). This defect could indicate a family relationship between these two elderly females. However, antemortem tooth loss caused by pulpa exposure as a result of their special use can not be excluded.

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Reconstruction and analysis of the Le Moustier 1 skull using CT-data. J. L. THOMPSON, Anthropology, University of Toronto, Ontario, Canada. M1C 1A4 and B. ILLERHAUS Bundesanstalt für Material-forschung und-Prüfung, Unter den Eichen 87, 122000, Berlin, Germany.

The Le Moustier 1 specimen, housed at the Museum für Vor- und Frühgeschichte, Berlin, is a Neandertal male dating to c. 40,000 BP. It is the only adolescent Neandertal specimen to preserve associated dental, cranial, and skeletal elements and so is of vital importance in the study of

Neandertal ontogeny. The reconstruction and analysis of the Le Moustier 1 skull using CT-data has provided details of ontogenetic and phylogenetic importance.

The skull is currently represented by several separate pieces, many of which are made up of various fragments. The skull pieces were scanned using a 3-D microtomograph with a spatial resolution minimum of 15µm, a contrast resolution of 1-5%, and slice thickness of 0.1mm. These data were viewed using Advanced Visualisation Systems (AVS) software allowing editing of CT images, volume filling, and the 3-D geometry of the fossil pieces to be reconstructed. As currently reconstructed, some of the larger cranial fragments are misaligned, the reconstructed frontal and occipital bones show some asymmetry, and several cranial and gnathic fragments are made from a compound painted to match the colour of the fossilized bone. Using the CT-data and the AVS software, the aim of this analysis was to remove the false material, correctly realign the cranial and gnathic fragments, and make a new reconstruction of the cranial vault and jaws. In addition, we used the CT-data to examine the morphology of the frontal sinus, endocranial structures like the bony labyrinth of the ear, extent of taurodontism, and dental development. Generation and analysis of the endocranial cast is planned.

This analysis adds to previous work that has demonstrated that despite its immature status, Le Moustier 1 possesses numerous features typical of adult Neandertals (Thompson & Bilsborough, 1996). These features include sinuses that fill the supraorbital torus near glabella and do not extend up into the frontal squamous (although they do not extend laterally to mid-orbit), taurodont molars, and a bony labyrinth with derived Neandertal features, extending our knowledge of Neandertal morphological variation. It also reveals the extent of formation of the 3rd molars, confirming a dental age at death of c.15.5 years (Thompson, 1995) and that the remaining dentition were fully formed, including the impacted lower left canine, so contributing information relevant to our understanding of Neandertal ontogeny.

Health, nutrition and demographic change in native California. R.THORNTON and P.L.WALKER, Department of Anthropology, UCLA, Los Angeles, CA 90095 and Department of Anthropology, UCSB, Santa Barbara, CA 93016.

We provide a broad historical perspective on changes in the health, nutrition and demography of California's population from the arrival of the earliest Paleo-Indian colonists until the present. Although some comparative data are available for nineteenth-century Euro-American skeletons, most of our bioarchaeological evidence derives from prehistoric Native American burials. Owing to the widespread practice of cremation by California Indians, large skeletal collections are only available from a few areas that allow for a statistical analysis of temporal variation in health and nutrition, i.e., the densely populated Santa Barbara Channel and Sacramento River Valley areas.

Prehistoric health conditions varied markedly through time within the same geographical area. Although some long-term trends can be discerned, short-term declines in health status linked to changes in local environmental productivity appear to have been common.

The arrival of Europeans marked the beginning of a new phase of California Indian history.

Newly encountered diseases became both epidemic and endemic in California Indian populations. Such diseases included smallpox, measles, typhus, cholera, diphtheria and syphilis. Because of these diseases, changing health, nutritional and demographic patterns and numerous episodes of genocide during the nineteenth century, the Native American population of California declined until around the beginning of the twentieth century. Then it reached a nadir population of less than 20,000, a tragic decline from its pre-European population size of a least 300,000 and perhaps substantially more. Today, California has one of the two largest native American populations in the United States, enumerated by the U.S. Census at over 200,000.

Vitamin D Receptor Genotype and Cortical Bone Density: An analysis of possible relationships. C. R. TILLQUIST, Department of Anthropology, University of Arizona, Tucson, AZ 85721.

This study examines the effects of vitamin D receptor (VDR) genotype on bone density variables in a population of older women (n=109, mean age=69.8 years). This study also estimates the repercussions on bone density of two important environmental variables—calcitropic therapy and smoking—in conjunction with VDR genotype.

This study finds no significant relationship between bone mineral density and VDR genotype. Furthermore, analyses reveal no significant association between VDR genotype and estimates of rate of bone loss.

The impact of certain environmental variables is divergent. The data show that use of calcitropic hormones has no statistically significant impact on bone density or rate of bone loss. There does seem to be, however, a significant relationship between smoking and initial bone density. This association ($F=4.53$, $p < 0.04$) can be largely attributed to the strong effect seen in individuals with a particular genotype (bb). The mechanism for a possible causative effect of smoking on bone density combined with this particular VDR genotype needs to be further explored.

This study suggests that the assessment of VDR genotype is a poor predictor of bone density variables of cortical bone in women of advanced old age. This research focused on the impact of a single gene, however, and perhaps other genes related to bone density may have significant effects. In the absence of this data, however, the results support the idea that genes related to bone density are of greater significance earlier in life while environmental effects are more significant later in life.